We claim:

1. A method comprising:

generating a phase-shift keyed optical signal; and

propagating the optical signal through a semiconductor optical amplifier in deep saturation to regulate the amplified optical power.

2. The method of claim 1 wherein the amplified optical power is regulated to about the saturation output power of the SOA.

3. The method of claim 1 wherein the gain recovery time of the optical amplifier is larger than the bit period of the optical signal.

4. The method of claim 1 wherein the optical signal has a data-independent intensity profile.

5. The method of claim 1 wherein the optical signal is an RZ-DPSK signal.

6. The method of claim 1 wherein the optical signal is an $\pi/2$-DPSK signal.

7. The method of claim 1 wherein the optical signal is a constant-intensity DPSK signal.

8. The method of claim 1 wherein the optical signal is an RZ-DQPSK signal.

9. The method of claim 1 wherein ΔP_{OUT} (dB)/ ΔP_{IN} (dB) of the optical amplifier is less than about 0.25, wherein P_{OUT} is the power of the optical signal

output from the amplifier and P_{IN} is the power of the optical signal input into the amplifier.

10. A method for optical limiting amplification comprising:

propagating a phase-shift keyed optical signal having a data independent intensity profile through a semiconductor optical amplifier such that ΔP_{OUT} (dB)/ ΔP_{IN} (dB) is less than about 0.25, to regulate the amplified optical power, where P_{OUT} is the power of the optical signal output from the amplifier and P_{IN} is the power of the optical signal input into the amplifier.

11. The method of claim 10 wherein the gain recovery time of the optical amplifier is larger than the bit period of the optical signal.

12. The method of claim 10 wherein the optical signal is an RZ-DPSK signal.

13. The method of claim 10 wherein the optical signal is an $\pi/2$-DPSK signal.

14. The method of claim 10 wherein the optical signal is a constant-intensity DPSK signal.

15. The method of claim 10 wherein the optical signal is an RZ-DQPSK signal.

16. A channel power equalizer comprising:

a demultiplexer for demultiplexing an optical signal comprising a plurality of channels;

a multiplexer for multiplexing the plurality of optical channels; and

a plurality of semiconductor optical amplifiers optically coupled to the demultiplexer and the multiplexer and adapted to provide optical power equalization of the plurality of channels.

17. An optical signal processor apparatus comprising:

a semiconductor optical amplifier device adapted to operate in deep saturation and to receive an RZ-DPSK optical signal having an amplitude-shift keyed optical label portion, such that the optical label portion of the signal is removed upon propagation through the semiconductor optical amplifier device.

18. An optical add/drop multiplexer device comprising:

a demultiplexer for demultiplexing a multi-channel wavelength-division multiplexed phase-shift keyed optical signal;

a multiplexer for multiplexing at least one of the optical channels from the demultiplexer and at least one added channel; and

a plurality of semiconductor optical amplifiers optically coupled to the multiplexer, adapted to suppress transient optical power fluctuations and provide optical power equalization between the channels to be multiplexed.

19. An optical communication system for transmitting multi-channel phase-shift keyed optical signals comprising:

a plurality of semiconductor optical amplifiers,

wherein the system is adapted to transmit the optical signals such that the plurality of semiconductor optical amplifiers operate in deep saturation so as

to provide optical power equalization of a plurality of channels of the multi-channel optical signals.

20. An apparatus comprising:

a means for generating a phase-shift keyed optical signal; and

a means for propagating the optical signal through a semiconductor optical amplifier in deep saturation to regulate the amplified optical power.